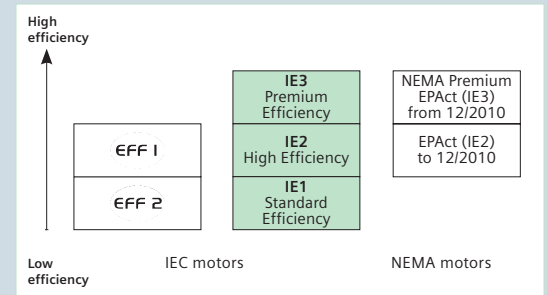


# New Efficiency Standards and Efficiencies for Low-Voltage Motors

Various energy efficiency standards exist worldwide for induction motors. This is the reason that the International Standard IEC 60034-30 (Rotating electrical machines – Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE code)) has been drawn-up to provide a unified standard worldwide. This classifies low-voltage induction motors in new efficiency classes (valid since October 2008). The efficiencies in IEC 60034-30 are based on the determination of losses according to the standard, part IEC 60034-2-1. This has been valid since November 2007, and from November 2010 onwards, replaces all previous EN 60034-2 standards. The additional losses are now measured and are no longer added as a fixed percentage.

The new efficiency classes have a new nomenclature: IE1 (Standard Efficiency), IE2 (High Efficiency), IE3 (Premium Efficiency), IE = International Efficiency.



## New IE1–IE3 efficiencies

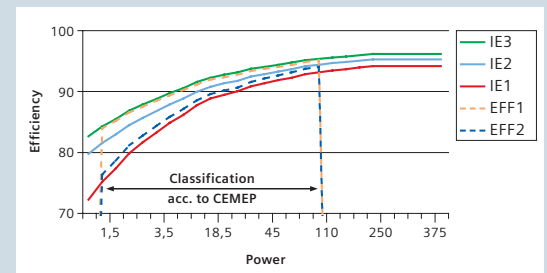
### New measuring methods

With the new measuring methods, the additional losses are no longer assumed as fixed percentage values (with 0.5%), but are determined by making the appropriate measurements (IEC 60034-2-1: 2007). This is the reason that the nominal efficiencies decrease from EFF1 to IE2 and from EFF2 to IE1 - although neither technical nor physical changes have been made to the motors.

Previously:  $P_{LL} = 0.5\%$  of  $P$  was added  
 Now:  $P_{LL}$  = Individual measurement

$P_{LL}$  = Load-dependent additional losses

### IE1-IE3 efficiencies, 4-pole 50 Hz



As an example, the efficiency values for 3 motors according to the new and the old loss determination methods are shown in the following table:

	Old EFF measuring methods (incl. fixed percentage losses) EN/IEC 60034-2: 1996 50 Hz	New loss determination methods according to IEC 60034-2-1: 2007 50 Hz	New loss determination methods according to IEC 60034-2-1: 2007 60 Hz
5.5 kW 4-pole	89.2 %	88.2 %	89.5 %
45 kW 4-pole	93.9 %	93.1 %	93.6 %
110 kW 4-pole	Not defined	94.5 %	95.0 %

# Motors

Answers for industry.

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## Background information

The EuP Directive (Energy Using Products) will be implemented in the national legislation of EU countries. The boundary conditions for the European legislation have already been passed. The EU Directive 2005/32/EC (=EuP Directive) is based on IEC 60034-30 regarding minimum efficiencies. In Germany, this

directive will be implemented with the so-called Energy-Using Products legislation (EBPG). The implementation measures regarding squirrel-cage induction motors are expected for April/May 2009.

## The most important changes at a glance

	<b>CEMEP</b> voluntary EU agreement	<b>NEMA EPAct</b>	<b>EuP Directive</b> based on standard IEC 60034-30 (EuP Directive still has to be passed; EuP = Energy Using Products)
Description	Voluntary agreement between the EU Commission and the European Committee of Manufacturers of Electrical Machines and Power Electronics CEMEP	The current legislation in the US / CAN / MX also regulates efficiencies	The EuP Directive must be implemented in national legislation in all European Countries. IEC 60034-2-1 is the basis for determining losses and therefore determining the efficiency.
Number of poles	2, 4	2, 4, 6	2, 4, 6
Power range	1.1 – 90 kW	0.75 – 150 kW	0.75 – 375 kW
Level	Standard – EFF3 Improved efficiency – EFF2 High efficiency – EFF1	High Efficiency NEMA Premium	Standard Efficiency – IE1 High Efficiency – IE2 Premium Efficiency – IE3
Voltage	400 V, 50 Hz	230/460 V, 60 Hz	< 1000 V, 50/60 Hz
Degree of protection	IP5X	Open + enclosed motors (IP23 + IP56)	All
Motors with brake	NO	YES	Being harmonized
Geared motors	NO	NO	YES
Explosion-proof motors	NO	YES	EuP Directive – being harmonized IEC 60034-30 – YES (however, explosion protection always has the higher priority)
Validity	Voluntary agreement; this will be withdrawn when national implementation comes into effect	Up to 12/2010 NEMA EPAct (IE2) From 12/2010 NEMA Premium (IE3) minimum efficiency	Standard IEC 60034-30, valid since October 2008, EuP (measures still have to be finally passed), legal transition period is then 36 months.

### Additional information:

- Probably excluded: Explosion-proof motors according to ATEX, brake motors, smoke extraction motors
- Probable date 16.06.2011: IE2 minimum efficiency for motors from 0.75 kW – 375 kW
- Probable date 01.01.2015: IE3 minimum efficiency for motors from 7.5 kW – 375 kW or the combination of IE2 motor and frequency converter
- Probable date 01.01.2017: IE3 minimum efficiency for all motors from 0.75 kW – 375 kW or the combination of IE2 motor and frequency converter

### Abbreviations:

- CEMEP** – Comité Européen de Constructeurs de Machines Électriques et d'Électronique de Puissance  
**NEMA** – National Electrical Manufacturers Association  
**IEC** – International Electrotechnical Commission  
**IE** – International Efficiency

Sources: IEC 60034-30; IEC 60034-2-1; EuP/Ecological Design Guideline (2005/32/EC); EBPG  
 Status: March 2009

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 Industry Sector  
 Drive Technologies

Subject to change without prior notice 04/09  
 Order No.: E80001-A470-P220-X-7600  
 DISPO 21505  
 SCHÖ/15735 GD.SD.SM.SDSM.52.9.04 SB 04092.5  
 Printed in Germany  
 © Siemens AG 2009

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